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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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09/914,204

02/20/2002

John Macneil

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1923

7590

05/24/2004

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EXAMINER

TSOY, ELENA

ART UNIT

PAPER NUMBER

1762

DATE MAILED: 05/24/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 09/914,204	<b>Applicant(s)</b> MACNEIL ET AL.	
	<b>Examiner</b> Elena Tsoy	<b>Art Unit</b> 1762	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 08 April 2004.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1 and 3-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 3-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. §§ 119 and 120

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All   b) ☐ Some \*   c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                               | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>1,2,3,4</u> . | 6) <input type="checkbox"/> Other: _____                                    |

***Response to Amendment***

1. Amendment filed on April 8, 2004 has been entered. Claim 2 has been cancelled. New claims 20 and 21 have been added. Claims 1, 3-21 are pending in the application.

***Claim Objections***

2. Objection to claim 12 because of the informalities has been withdrawn.

***Double Patenting***

3. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

4. **Claims 1, 3-7, 9-20** are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 2, 3, 7, 8, 15, 20, 31 of U.S. Patent No. 6,544,858 in view of Tsukune et al (US 5,314,724). Patent '858 discloses a method of depositing a silicon containing-polymer on a semiconductor wafer (See Claim 20) from silicon containing compound such as higher silane (See Claim 2) and hydrogen peroxide (See Claim 3) to a thickness of 0.3-0.5 microns (3000-5000 Angstroms) (See Claim 35) thus forming a polymer layer of claimed invention having thickness of 3000-5000 Angstroms and including Si-C bonds,

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and heating the polymer layer by a heated platen (See Claim 7) to a temperature of 300<sup>0</sup>C -500<sup>0</sup>C (See Claim 8) thereby densifying (hardening) (See Claim 31) the layer (and desorbing moisture), and treating the heated layer with RF plasma having power of less than 1 MHz (i.e. about 500 watts) (Claim 10) such as oxygen plasma (See Claim 5).

Patent '858 fails to teach that the treating plasma is hydrogen plasma (Claim 1).

Tsukune et al teach that the plasma treatment can be conducted by oxygen plasma or hydrogen plasma (See column 12, lines 21-27). In other words, Tsukune et al teach that hydrogen plasma is functionally equivalent to oxygen plasma for plasma treatment.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used hydrogen plasma instead of oxygen plasma in Patent '858 since Tsukune et al teach that hydrogen plasma is functionally equivalent to oxygen plasma for plasma treatment, and the selection of any of these known plasma treatment in Patent '858 would be within the level of ordinary skill in the art.

As to claims 10, 11, 13,15, 16, Li fails to teach that the polymer film is treated by plasma for 2-4 minutes (Claims 10, 11 and 13) to a depth of more than 3000 Angstroms (Claim 15) or less than 600 Angstroms (Claim 16).

One of ordinary skill in the art at would recognize that properties of heat and plasma treated polymer layer would depend on treating time and the depth of treating the polymer layer. In other words, treating time and treating depth are result-effective parameters in a polymer treating process.

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It is held that it is not inventive to discover the optimum or workable ranges of result-effective variables by routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum values of the relevant treating time and depth parameters (including those of claims 10, 11, 13, 15, 16 and 21) in Patent '858 in view of Tsukune et al through routine experimentation in the absence of a showing of criticality.

***Claim Rejections - 35 USC § 102***

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

6. Rejection of claims 1, 3, 12, 14, 17-19 under 35 U.S.C. 102(b) as being anticipated by Beekman et al (WO 98/08249) has been withdrawn.

7. Rejection of claims 1, 3, 14, 18, 19 under 35 U.S.C. 102(b) as being anticipated by Makita et al (US 5,619,044) has been withdrawn.

8. Rejection of claims 1, 3-12, 14, 17-19 under 35 U.S.C. 102(e) as being anticipated by Li (US 6,383,951) has been withdrawn.

9. **Claims 1, 3, 10, 14, 17-20** are rejected under 35 U.S.C. 102(b) as being anticipated by Tsukune et al (US 5,314,724).

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Tsukune et al are applied here for the reasons of record as set forth in Paragraph No. 5 of the Office Action mailed on December 8, 2003. Although Tsukune et al do not expressly show that the polymer layer deposited on a substrate includes carbon after heat and plasma treatment, it is the Examiner's position that the polymer layer of Tsukune et al would still include some or even traces of carbon (i.e. Si-C bonds) because: (i) it is generally impossible to completely remove every possible Si-C bond; and (ii) the treatment of the deposited polymer layer in Tsukune et al to remove organic groups (i.e. Si-C bonds) from the polymer layer which includes heating to temperature of 250<sup>0</sup>C -450<sup>0</sup>C (See column 11, lines 32-33) and exposing to H<sub>2</sub> plasma maintained by RF power of 100-500 watts (See column 14, lines 14-16) for 5-60 seconds at the same temperature (See column 12, lines 16-43) is somewhat **milder** than the treatment of claimed invention which includes heating to a temperature of 350<sup>0</sup>C -550<sup>0</sup>C (See Claims 12, 13) and exposing to H<sub>2</sub> plasma maintained by RF power (Claim 4) of 400-750 watts (Claims 5, 7, 9) for 2-4 minutes at the same temperature (See Claims 10, 11, 13) so that plasma treatment under conditions of Tsukune et al would remove *less* organic groups (i.e. Si-C bonds) from the polymer layer than the treatment of claimed invention.

### ***Claim Rejections - 35 USC § 103***

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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11. **Claims 1, 3-21** are rejected under 35 U.S.C. 103(a) as being unpatentable over Li (US 6,383,951) in view of Tsukune et al (US 5,314,724).

Li discloses a method of processing a polymer layer including Si-C bonds (See column 4, lines 23-24) deposited on a substrate such as silicon (semiconductive) wafer (See column 1, line 14; column 7, lines 28-29) by CVD from tetraethylorthosilicate (TEOS) (See column 6, lines 14-23), or methyl silane and hydrogen peroxide (See column 4, lines 28-41), including the steps of heating the polymer layer to temperature of 400<sup>0</sup>C -800<sup>0</sup>C (See column 5, lines 46-50) to desorb moisture (See column 6, lines 3-5), and exposing the layer to a plasma such as oxygen plasma for 5-90 seconds (See column 5, lines 11-16) during the heating process (See column 5, lines 57-61). The dielectric constant of the processed polymer layer is below 3.00 (See column 6, lines 8-10). The substrate on which the polymer layer is formed may be supported on a pedestal (platen) including heating resistive heating elements (See column 5, lines 60-63). RF power of between about 0.1 kW and 1 kW, more preferably about 0.5 kW was applied to the electrodes of a plasma reactor (See column 5, lines 31-37). However, the ionizing power can be coupled to the gas by way of microwave plasma or inductively coupled plasma as well (See column 5, lines 28-29). The gate electrode may directly contact the insulating polymer layer 40 (See column 10, lines 30-40), i.e. the insulating polymer layer 40 may be supported on the electrode.

Li fails to teach that the treating plasma is hydrogen plasma.

Tsukune et al teach that the plasma treatment can be conducted by oxygen plasma or hydrogen plasma (See column 12, lines 21-27). In other words, Tsukune et al teach that hydrogen plasma is functionally equivalent to oxygen plasma for plasma treatment.

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It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used hydrogen plasma instead of oxygen plasma in Li since Tsukune et al teach that hydrogen plasma is functionally equivalent to oxygen plasma for plasma treatment, and the selection of any of these known plasma treatment in Li would be within the level of ordinary skill in the art.

It is the Examiner's position that a polymer layer having Si-C bonds deposited by CVD from methyl silane and hydrogen peroxide would harden under heating, and the processed polymer layer of Li in view of Tsukune et al would have claimed properties such as and improved wet etch rate and would include carbon (i.e. Si-C bonds) since it is prepared and processed by the method substantially identical to that of claimed invention (See specification, page 6, lines 3-15).

As to claims 15, 16, 21, Li fails to teach that the polymer film is treated by plasma to a depth of more than 3000 Angstroms (Claim 15) or less than 600 Angstroms (Claim 16) and has thickness of 7000-9000 Angstroms (Claim 21).

One of ordinary skill in the art at would recognize that properties of heat and plasma treated polymer layer would depend on thickness of the layer and the depth of treating the polymer layer. In other words, thickness and treating depth are result-effective parameters in a polymer treating process.

It is held that it is not inventive to discover the optimum or workable ranges of result-effective variables by routine experimentation. In re Antonie, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also In re Boesch, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).



It would have been obvious to one of ordinary skill in the art at the time the invention was made to have determined the optimum values of the relevant thickness and depth parameters (including those of claims 15, 16 and 21) in Li in view of Tsukune et al through routine experimentation in the absence of a showing of criticality.

### *Response to Arguments*

12. Applicant's arguments with respect to claims 1, 3-21 have been considered but are moot in view of the new ground(s) of rejection.

### *Conclusion*

13. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

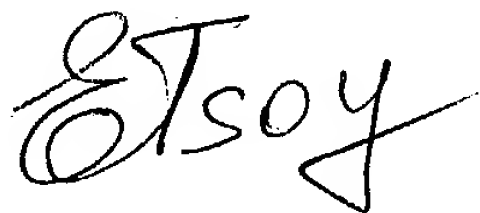
A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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14. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy whose telephone number is (571) 272-1429. The examiner can normally be reached on Mo-Thur. 9:00-7:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive Beck can be reached on (571) 272-1415. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'ETsoy', is positioned above the typed name of the examiner.

Elena Tsoy  
Primary Examiner  
Art Unit 1762

May 19, 2004